R E P O R T

TO THE

Environmental Assessment Panel - Lepreau 2

October 1984

Fernand MATTART
Dept. of Economics
Université de Moncton

O U T L I N E

		PAGES
1.	INTRODUCTION	2
2.	GENERAL CONTEXT OF SOCIOECONOMIC ANALYSIS	3
3.	CONSTRUCTION AND OPERATION PHASES AT THE PROVINCIAL LEVEL	5
	3.1 Construction Phase	6
	3.2 Operation Phase	7
	3.3 Comparison with New Brunswick Input-Output Tables (1979)	7
	3.4 Employment Impacts	10
4.	CONSTRUCTION AND OPERATION PHASES AT THE SUBREGIONAL LEVEL	12
	4.1 Labour Requirements	13
	4.2 Community Impacts	13
5.	CONSIDERATION OF RISKS	14
6.	DECOMMISSIONING	16

1. INTRODUCTION

In any project analysis, the major contribution economic techniques can make consists in providing a COMPARISON of two or more projects as the basis on which to select the one which will best achieve a predetermined objective: profitability, impacts on employment and income, foreign exchange gain, etc.

Because the frame of reference imposed on the Panel restricts us to studying solely the spin-offs of a SINGLE project, the role of the economist must of necessity be very limited. The fact is that any project, whatever it may be, always has positive spin-offs. . .

The remarks which follow, therefore, can only be very limited. They will focus essentially on indicating whether the Report analyzed the impact of LEPREAU 2 correctly.

In the pages to follow, "Report" means the text entitled "LEPREAU 2: Statement of Impact on the Environment." (WASHBURN and GILLIS ASSOCIATES, May 1984).

2. GENERAL CONTEXT OF SOCIOECONOMIC ANALYSIS

1) From the economic standpoint, three phases must be distinguished:

- construction
- operation
- decommissioning

2) From the geographical standpoint, there is a distinction between levels:

- Canadian
- interregional (in this context the term "region" means a unit of several provinces: Atlantic region, Western Canada region, etc.)
- provincial
- subregional. The assessment criteria established by the Panel (page A-17) require that there be four distinct subregions:
  - Pointe-Lepreau
  - Greater Saint John
  - St. Stephen - Saint John subregion
  - Fredericton central subregion

3) Theoretically then, this would require the study of 15 distinct cases: the three phases of the project and the five geographical levels (4 subregions plus the province).

Such a study was not undertaken systematically by the Report.

In fact, the Report presents more significant and reliable figures for the three Canadian, regional, and provincial levels than it does for the four subregional levels. It becomes evident, however, that it was not always possible to proceed otherwise.

In view of the documents available and the questions asked by the Panel, comments on the Report will focus on the following four aspects:

- construction and operation phases at the provincial level
- construction and operation phases at the subregional level
- consideration of risks
- decommissioning phase

3. Construction and Operation Phases at the Provincial Level

This problem is dealt with in sections 7.5, 7.6, and 7.7 in the Report where the economic impacts, employment impacts, and income effects of the project are analyzed successively.

The Report is based on the use of the INPUT-OUTPUT tables, more specifically, on "The 1974 Interregional Input/Output Model" of Statistics Canada.

Personally, I did not have the opportunity to work with this model, so I cannot pass judgment on how it was used in the Report.

Nevertheless, since it constitutes an instrument widely used by economists, I have no objection to the methodology, and consider the analysis presented in sections 7.5 to 7.7 to be perfectly acceptable from the standpoint of principles.

On the other hand, some of the figures proposed do encourage certain reservations.

Working with the last INPUT/OUPUT tables available for New Brunswick (1979), I was able to check some of the multipliers used. The comparison indicated that the multiplier proposed by the Report for the construction phase is too optimistic, whereas the multiplier for the operation phase corresponds closely with the data at my disposal.

3.1 Construction Phase

In Table 7-6, the Report uses a multiplier for New Brunswick equal to

2400/ = 2.28

According to the NB tables for 1979, the multiplier for nonresidential construction is only 1.76 (see Table 1, page 8)

Even this multiplier of 1.76 seems to me too high, for the following reasons:

- it does not take into account the "leaks" due to imports from the other provinces.

- it gives an average focused on nonresidential construction inputs. Yet, the construction of a nuclear power station is a classic example of a leading industry. The share of the other provinces in the construction should therefore be higher than the average (1).

Finally, and especially, the Report does not indicate that the salary expenditure with regard to construction represents only a marginal contribution in relation to the sums already spent in the province for unemployment and social welfare.

For example, if a monthly salary of $1000 replaces an unemployment allowance of $400, the net multiplier must be calculated not on $1000, but on $600(2).

(1) This point is confirmed by the LEPREAU 1 analysis: labour force expenditures during the construction phase represented a sum of $208.5 million (pages 7-36 and 7-37). This gives a labour coefficient of 0.14, whereas the average coefficient for construction is 0.34 (see Table 1).

(2) Section 7-8 of the Report is confirmation itself of the extent of unemployment in the subregions.

3.2 Operation Phase

In Table 7-7, the Report gives a multiplier of

408 / 363 = 1.12

The NB tables (1979) give a multiplier rather close to 1.52 (see Table 2, page 9).

However, the latter figure is not strictly comparable, because it gives the multiplier related to the category of "other public utility services" which include electricity, gas supply, water, and other services. Moreover, it does not take into account the "leaks" due to imports from the other provinces.

3.3 Comparison with Input/Output Tables of N.B. (1979)

By way of illustration, Tables 1 and 2 included here present, respectively, the effects of one dollar spent on nonresidential construction, and on "other public utility services" (OPUS), according to the NBTables (1979).

The columns are to be interpreted as follows:

Col 1 - Multiplier effect on the 44 industrial sectors of the province of one dollar spent on nonresidential construction (and on OPUS).

It is evident that the complete multiplier is 1.76 (and 1.52).

Col 2 - Labour coefficient (that is, salary plus unincorporated businesses income) for each industrial sector. For example, for an OUTPUT of 1 dollar, agriculture pays 0.4 dollar for labour, forestry industry, 0.36, etc.

Col 3 This is Col 1 multiplied by Col 2: the result gives, for each industrial sector, the labour expenditures caused by one dollar spent on nonresidential construction (and on OPUS).

Note: All these coefficients do not take into accounts imports from the other provinces.

TABLE ONE

MULTIPLIER EFFECTS OF ONE DOLLAR IN NONRESIDENTIAL CONSTRUCTION

				(see text)
1	AGRICULTURE	.0031	.4036	.0012
2	FORESTRY	.0252	.3590	.0091
3	FISHING AND HUNTING	.0007	.5784	.0004
4	METAL MINES	.0058	.1778	.0010
5	MINERAL FUELS	.0009	.2484	.0002
6	NONMETAL MINES	.0043	.2457	.0011
7	MINING SERV.	.0036	.3386	.0012
8	FOOD AND BEVERAGE	.0081	.1723	.0014
9	TOBACCO	.0000	.0000	.0000
10	RUBBER TIRES	.0000	.0000	.0000
11	LEATHERS SHOES	.0000	.0000	.0000
12	TEXTILE IND.	.0056	.1026	.0006
13	STOCKINGS SWEATERS	.0000	.0000	.0000
14	CLOTHING IND.	.0000	.0000	.0000
15	WOOD IND.	.0645	.2435	.0155
16	FURNITURE	.0011	.3191	.0003
17	PAPER	.0142	.1898	.0027
18	PRINTING PUBLISHING	.0060	.1240	.0038
19	IRON AND STEEL	.0000	.0000	.0000
20	METAL MANF'G	.0730	.3096	.0226
21	MACHINE MANF'G	.0010	.3505	.0004
22	VEHICLES	.0000	.0000	.0000
23	ELECTRICAL APP.	.0000	.0000	.0000
24	NONMETAL PROD MANF'G	.0000	.0000	.0000
25	REFINERIES	.0732	.2209	.0162
26	CHEMISTRY	.0000	.0000	.0000
27	MISCELLANEOUS IND.	.0119	.0927	.0011
28	CONSTRUCTION	.0041	.3531	.0014
29	TRANSPORTATION STORAGE	1.0066	.3374	.3396
30	COMMUNICATIONS	.0446	.2711	.0121
31	ELECTRICITY, GAS, WATER	.0155	.4413	.0068
32	WHOLESALE TRADE	.0098	.1452	.0014
33	RETAIL TRADE	.0636	.4873	.0310
34	BUILDINGS OCCUPIED BY PROF.	.0137	.4851	.0066
35	OTHER FIN, INSUR, REAL ESTATE	.0000	.0255	.0000
36	EDUCATION AND MED SERV.	.0353	.2358	.0083
37	AMUSEMENT RECREATION	.0051	.7225	.0037
38	SERV TO BUSINESS	.0026	.2738	.0007
39	ACCOMODATION FOOD SERVICE	.0416	.4695	.0195
40	OTHER PERSONAL SERV.	.0123	.4128	.0051
41	TRANSPORTATION	.0030	.5665	.0017
42	OFFICE SUPPLIES	.0255	.0000	.0000
43	TOURISM AND PUBLICITY	.0441	.0000	.0000
44	CONFIDENTIAL	.0175	.0000	.0000
		.1091	.3712	.0079
		1.7560	[illegible]	.5246

TABLE TWO

MULTIPLIER EFFECTS OF ONE DOLLAR IN OTHER PUBLIC UTILITIES

(see text)

1	AGRICULTURE	.0010	.4036	.0004
2	FORESTRY	.0067	.3590	.0024
3	FISHING AND HUNTING	.0003	.5764	.0002
4	METAL MINES	.0150	.1779	.0027
5	MINERAL FUELS	.0026	.2484	.0006
6	NONMETAL MINES	.0006	.2457	.0001
7	MINING SERV.	.0005	.3386	.0002
8	FOOD AND BEVERAGE	.0036	.1733	.0006
9	TOBACCO	.0000	.0000	.0000
10	RUBBER TIRES	.0000	.0000	.0000
11	LEATHERS SHOES	.0000	.0000	.0000
12	TEXTILE IND.	.0008	.1026	.0001
13	STOCKINGS SWEATERS	.0000	.0000	.0000
14	CLOTHING IND.	.0000	.0000	.0000
15	WOOD IND.	.0039	.2405	.0009
16	FURNITURE	.0002	.3141	.0001
17	PAPER	.0306	.1888	.0058
18	PRINTING PUBLISHING	.0041	.6240	.0026
19	IRON AND STEEL	.0000	.0000	.0000
20	METAL MANF'G	.0051	.3096	.0016
21	MACHINE MANF'G	.0003	.3505	.0001
22	VEHICLES	.0000	.0000	.0000
23	ELECTRICAL APP.	.0000	.0000	.0000
24	NONMETAL PROD MANF'G	.0027	.2209	.0006
25	REFINERIES	.0000	.0000	.0000
26	CHEMISTRY	.0041	.0927	.0004
27	MISCELLANEOUS IND.	.0009	.3531	.0003
28	CONSTRUCTION	.0170	.3374	.0057
29	TRANSPORTATION STORAGE	.0172	.2711	.0047
30	COMMUNICATIONS	.0074	.4413	.0033
31	ELECTRICITY, GAS, WATER	.9803	.1452	.1424
32	WHOLESALE TRADE	.0270	.4873	.0132
33	RETAIL TRADE	.0036	.4851	.0017
34	BUILDINGS OCCUPIED BY PROF.	.0000	.0255	.0000
35	OTHER FIN, INSUR, REAL ESTATE	.0347	.2358	.0082
36	EDUCATION AND MED SERV.	.0016	.7225	.0012
37	AMUSEMENT RECREATION	.0009	.2738	.0002
38	SERV TO BUSINESS	.0087	.4695	.0041
39	ACCOMODATION FOOD SERVICE	.0041	.4128	.0017
40	OTHER PERSONAL SERV.	.0016	.5665	.0009
41	TRANSPORTATION	.0099	.0000	.0000
42	OFFICE SUPPLIES	.0288	.0000	.0000
43	TOURISM AND PUBLICITY	.0105	.0000	.0000
44	CONFIDENTIAL	.2825	.0722	.0204
		1.5187	10.2466	.2272

3.4 Employment impacts:

Colum 3 in both tables provides verification of the employment impacts caused by LEPREAU 2.

It is evident that:

1) one dollar spent in nonresidential construction causes expenditure (direct or indirect) of 0.5246 dollar for labour.

Since the total construction cost is estimated at $1051 million, the salaries distributed will be in the order of $551 million.

It is difficult to compare these figures with those given in the Report which, after presenting the multiplier effects on income in dollars, gives the multiplier effects on employment in numbers of jobs. It would have been helpful to have information on the method used in the Report to convert dollars into jobs: labour coefficients, average salaries, etc.

In Table 7-12, the Report indicates that 9944 person-years of direct employment will be created, and 7591 of indirect employment; that is, a total of 17,535.

The multiplier is therefore

17535 / 9944 = 1.76

By way of comparison, our Table 1 gives, for one dollar in nonresidential construction, a direct employment of 0.3374 dollar and a total employment (direct and indirect) of 0.5246 dollar. The multiplier is therefore

0.5246 / 0.3374 = 1.55

2) one dollar spent on "other public utility services" causes an expenditure of 0.23 dollar for labour.

If the annual expenditure is assumed to be $64 million (page 7-24), total salaries would be in the order of

64 x 0.23 = $14.72 million

This is therefore quite close to the figure of $17 million proposed by the Report (page 7-24).

4. CONSTRUCTION AND OPERATION PHASES AT THE SUBREGIONAL LEVEL

Economic statistics providing a set of consistent, integrated data are available for the first three geographic levels (Canada, regions, and provinces).

However, there are no integrated economic accounts for the fourth level (subregions), but simply partial statistical series related to demography, employment, and a portion of the income. Although the Report also used the Lepreau I project, the conclusions which can be drawn as to this level will necessarily be more precarious.

In fact, the Report did not systematically analyse the economic spin-offs of LEPREAU 2 in the four subregions defined by the Panel, but touched on certain specific points only.

We believe, however, that, considering the lack of statistics at the local level, and the extensive mobility at this level, (labour can come from subregion A or B, live in either B or C, shop in A or C. etc.), greater precision would have been misleading. The Report therefore cannot be criticized for gaps in this matter.

The subregional impact is studied essentially in sections 7.4 and 7.5 which analyze labour requirements, as well as in section 7.8 which is devoted to community impacts.

4.1 Labour Requirements

The report made a considerable and worthwhile effort to quantify the labour supply and demand during the construction phase.

I did not have either the opportunity or the time required to check these figures.

4.2 Community Impacts

This part of the Report is quite disappointing. Indeed, available statistics are insufficient, and the impact at the subregional level is difficult or impossible to measure. However, the Report wishes to show that the project's effects can be nothing but beneficial in all regards. In taking this point of view, it does not back down in the face of certain contradictions -

For example, the Report notes that :

- Because of existing unemployment, the majority of workers could be recruited locally, and "population and housing effects related to Lepreau 2 are expected to be minor" (page 7-39)

- In Fredericton, "the multiplier effects will likely be marginal" (page 7-40)

- The government service impacts will be negligeable (page 7-48 - 7-49)

- The increase in housing prices will depend more on the general economic climate and the drop in interest rates than on Lepreau 2 (page 7-54_

We are not challenging these facts, but we see that they all reinforce our point of view that the various multiplier effects of the project are probably exaggerated (see section 3.1 above).

5. CONSIDERATION OF RISKS

It is not up to an economist to analyze the risks and pollution caused by the nuclear industry.

However, the authors of the Report ought to be asked the following questions :

1) The New Brunswick Electric Power Commission has a $75 million nuclear liability insurance policy (page E-23).

What exactly are the risks covered by this insurance?

Conversely, what are the risks that are not covered?

2) Apart from the matter of actual risks, there is the more general matter of pollution.

It is known that, in general, pollution is discharged freely into the environment by firms; and when, after many years, the accumulated degree of pollution poses a problem (smog in the atmosphere, disappearance of all animal life in rivers or lakes, etc.), it is up to the whole community to take the necessary action to repair the damage.

To put it plainly, the taxpayers as a whole are the ones who must pay for the damage to the environment cause by a firm, even though this damage should be either the responsibility of the purchasers of the product, or be deducted from the firm's profits.

In the case of the nuclear industry, there are three types of "ordinary" (i.e., apart from incidents and risks as such) pollution;

- atmospheric pollution
- water pollution
- pollution during management of radioactive wastes.

It would be useful to have an expert's opinion as to whether the pollution control measures taken by the New Brunswick Electric Power Commission are sufficient.

6. DECOMMISSIONING PHASE

This point is studied in Appendix B of the Report.

The conclusions drawn in the Report itself need no comment :
"Maritime-Nuclear has not yet made a decision with regard to the specific decommissioning option for the Lepreau 2 reactor" (page B-35).

The Report estimates an annual sum of $1.83 million, incorporated in the sale price, for the decommissioning expenses (page B-36).

This sum, paid over 40 years and compounded at 10% interest, would give, after 40 years, a capital of $810 million (see Table 3).

Considering the experience acquired in Canada and in other countries, is this sufficient?

We note that :

1) This calculation was made on constant prices (1980 dollars). In order to maintain the purchasing power of this capital, the $1.83 million should be revalued annually, not in terms of the energy price index, but in terms of the general price index.

2) Table 3 gives the capitalization of the sum of $1.83 million paid annually over terms varying from 1 to 40 years, and for interest rates of 8, 10, and 12 percent.

2) Because of the exponential nature of compound interest, the last ten years of the power station's operation are of fundamental importance to the sum reserved for decommissioning. If Lepreau 2 is in operation for 30 years instead of 40, the capital available for decommissioning (invested at an interest of 10%) will be $301 million instead of $810 million.

TABLE THREE

CAPITALIZATION OF AN ANNUAL PAYMENT OF 1.83 MILLION

YEARS	8 PERCENT	10 PERCENT	12 PERCENT
1	1.83	1.83	1.83
2	3.81	3.84	3.88
3	5.94	6.06	6.18
4	8.25	8.49	8.75
5	10.74	11.17	11.67
6	13.42	14.12	14.95
7	16.33	17.36	18.54
8	19.47	20.87	22.51
9	22.85	24.85	27.04
10	26.51	29.17	32.11
11	30.46	33.91	37.80
12	34.73	39.17	44.14
13	39.34	44.88	51.20
14	44.31	51.19	59.08
15	49.69	58.14	68.00
16	55.49	65.78	78.24
17	61.74	74.20	90.44
18	68.57	83.45	104.02
19	75.98	93.62	119.06
20	83.74	104.81	137.94
21	92.27	117.12	158.51
22	101.48	130.67	182.23
23	111.47	145.56	209.42
24	122.19	161.95	240.83
25	133.78	179.99	276.96
26	146.32	199.80	318.11
27	159.85	221.61	365.85
28	174.47	245.60	420.72
29	190.24	271.99	483.50
30	207.31	301.02	555.44
31	225.72	332.96	638.47
32	245.61	368.08	733.87
33	267.09	406.72	843.65
34	290.29	449.22	969.67
35	315.34	495.97	1114.94
36	342.40	547.40	1281.64
37	371.62	603.97	1474.09
38	403.18	666.20	1695.00
39	437.26	734.65	1951.74
40	474.07	809.94	1403.78